THE MACHINE LEARNING OUTLOOKS ON BEYOND TONNE-SCALE NEUTRINOLESS DOUBLE BETA DECAY EXPERIMENTS

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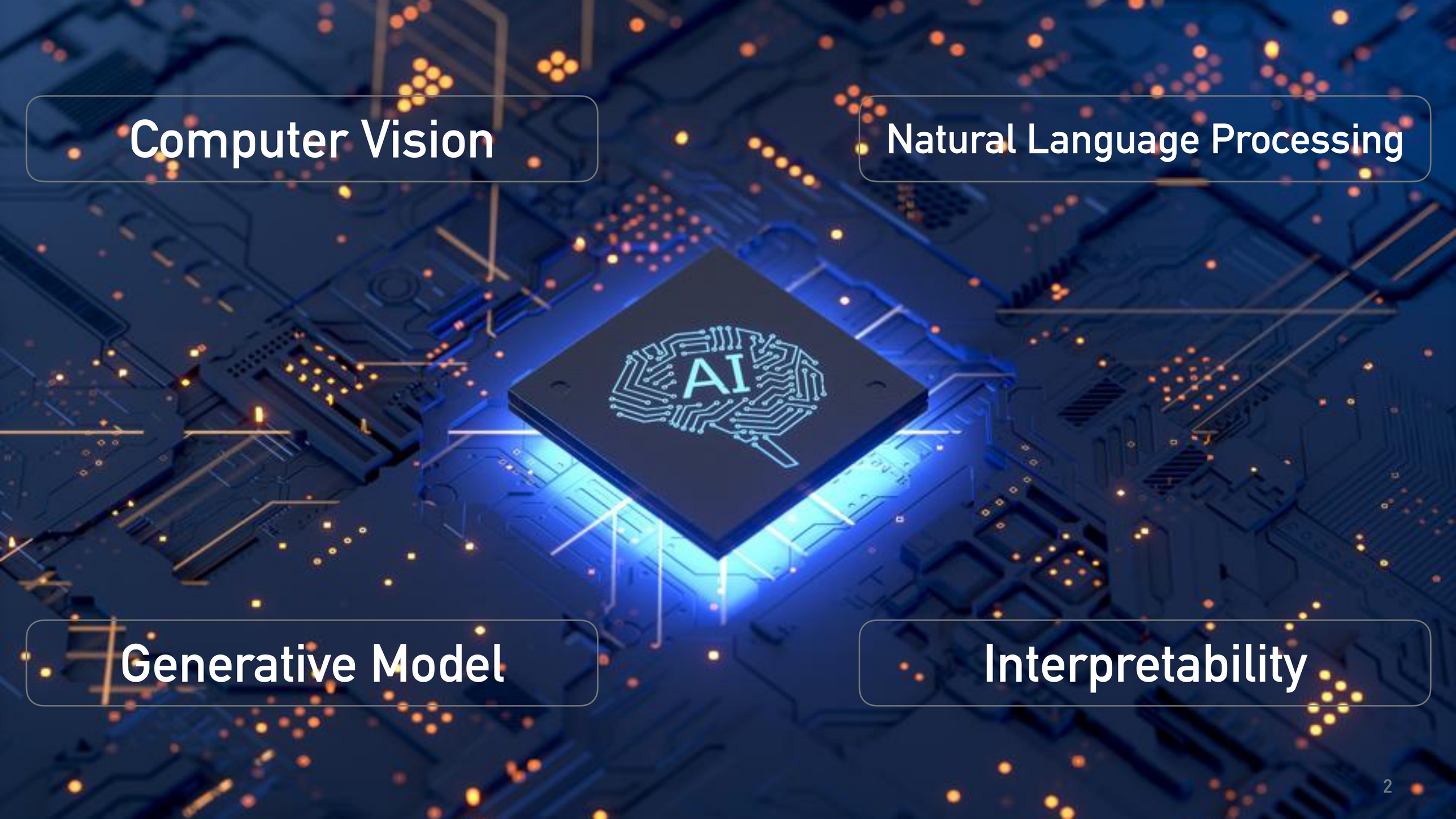
Computer Vision

Natural Language Processing

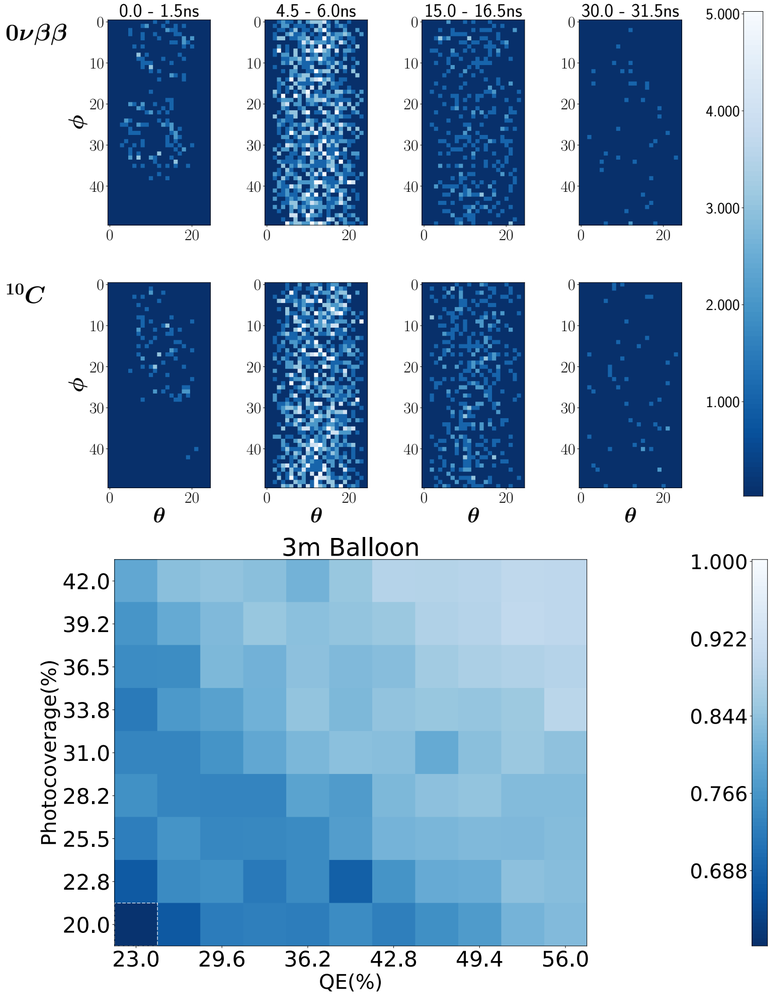


Generative Model

Interpretability

COMPUTER VISION

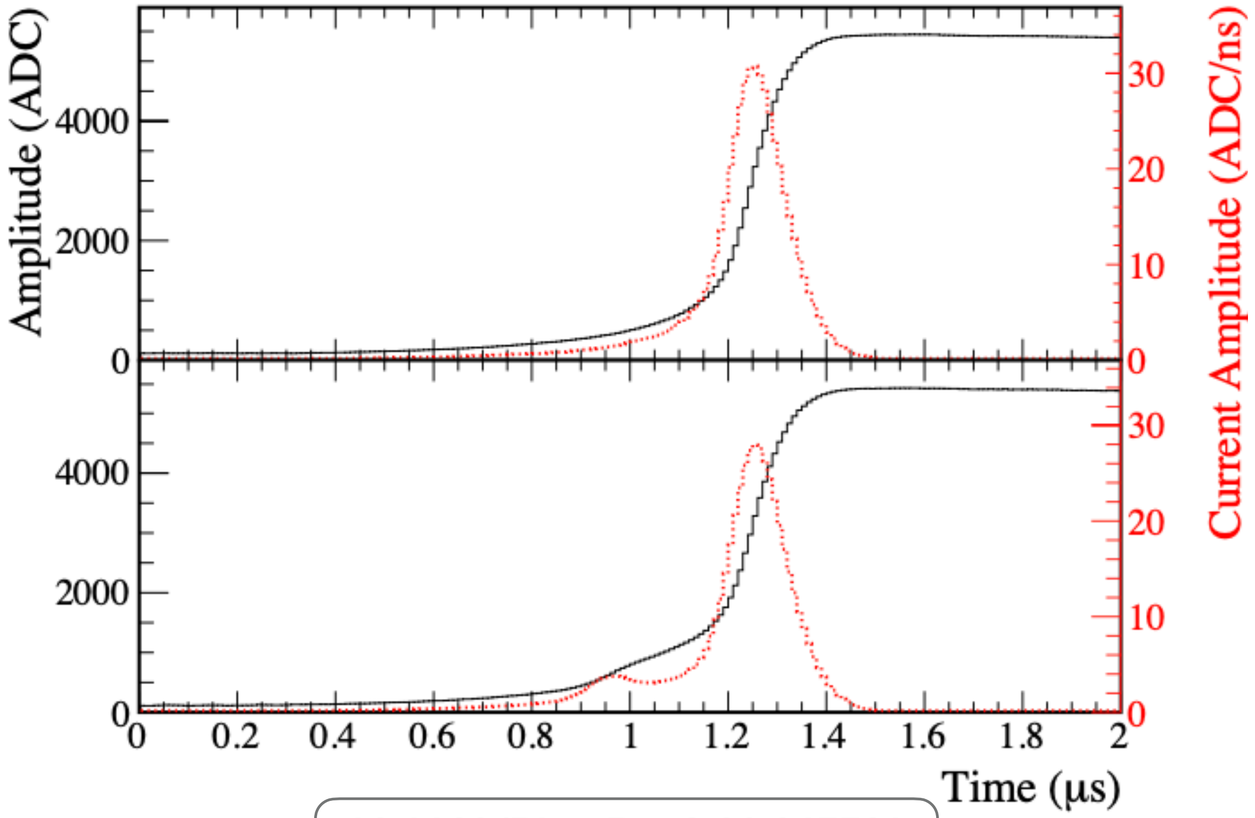
- Machine learning that focus on analyzing **images**
- Compatible with **monolithic** detector with many **spatially correlate** photosensors
  - Large Scale LS detector
  - TPC detector
- **Convolutional Neural Network** (CNN) and its variant is the most popular model
- **Versatile** for many kinds of tasks:
  - Particle Identification
  - Cherenkov/Scintillation seperation
  - Track Labeling via Semantic Segmentation
- Performance improves with **better detector hardware**



10.1016/j.nima.2019.162604

NATURAL LANGUAGE PROCESSING

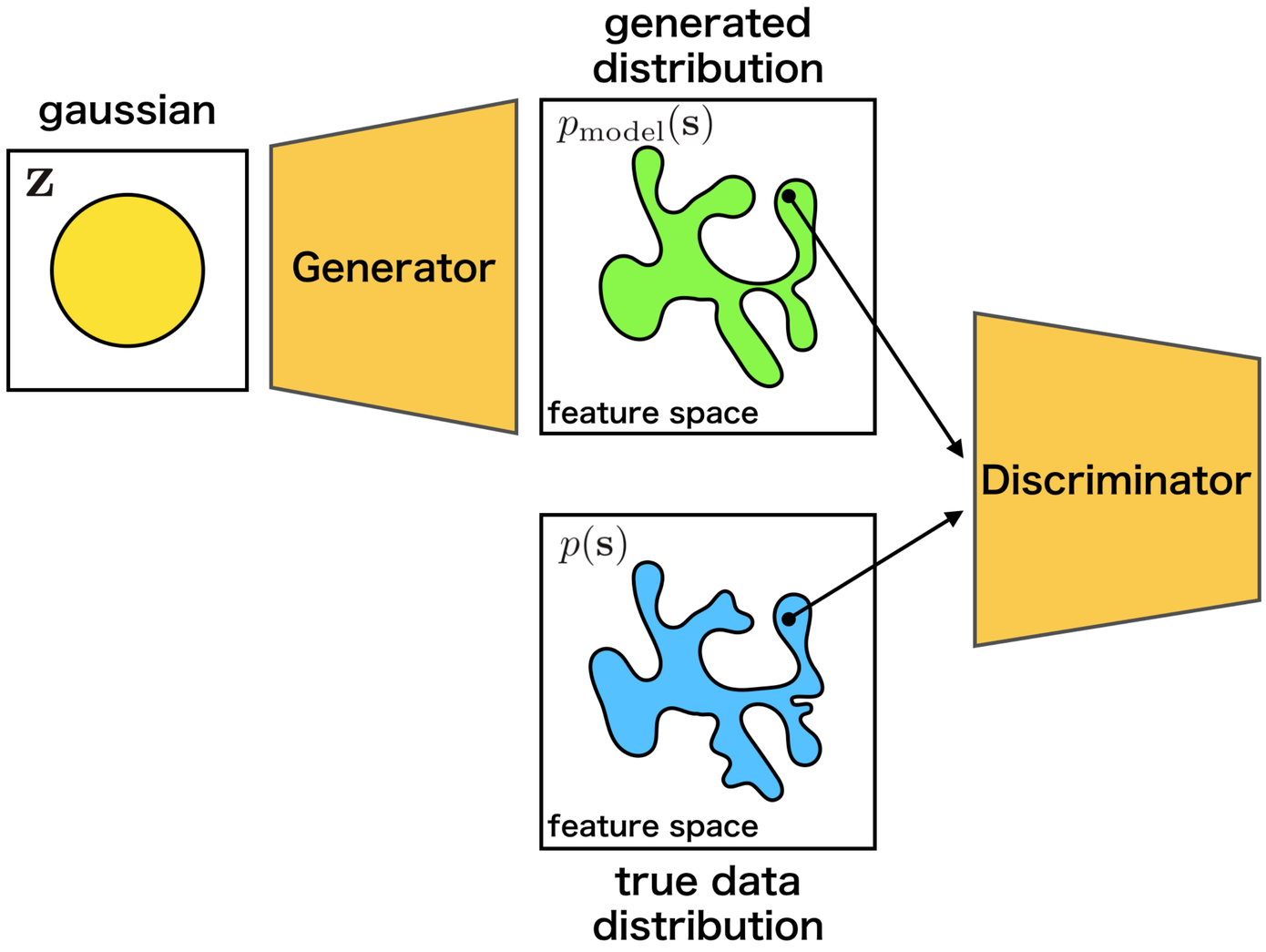
- Machine learning that focus on analyzing **time sequence (waveform)**
- Compatible with **granular** detector that outputs a **single waveform**
  - Bolometer
  - Germanium Detector
- Possible model: **RNN** based model, **1D CNN** model, **Attention** based model
- Applications: PID, waveform transformation



10.1103/PhysRevC.99.065501

GENERATIVE MODEL

- Generative Adversarial Network & Variational Auto-encoder
- Training GAN:
  - Train **generator** to generate fake images that "fool" the discriminator
  - Train **discriminator** to classify fake images from real images
- Generating **MC simulations** that are indistinguishable from true detector events



INTERPRETABILITY

- The ability to explain decisions of a machine learning models
- Tradeoff between **accuracy** and **interpretability**
- **Tree-based model** gains attention on interpretability
- **Black-box explainer**: explain regardless the type of models
- **Positive reciprocal relation** between classical model and interpretable machine learning model